CLAIMS

1. A cheese cooling apparatus comprising:

a tank for containing a liquid and having a cheese inlet and a cheese outlet;

an inlet flume coupled to the cheese inlet of the tank for conveying blocks of cheese;

an outlet flume coupled to the cheese outlet of the tank for conveying the blocks of cheese;

a carousel having a plurality of receptacles to hold the blocks of cheese and a drive mechanism attached to the plurality of receptacles to move each receptacle in a closed path within the tank and submerge the blocks of cheese in the liquid; and

a fluid circulation system for producing a flow of the liquid through the tank to cool the blocks of cheese.

2. The apparatus as recited in claim 1 wherein the carousel sequentially aligns each receptacle with the cheese inlet to receive blocks of cheese from the inlet flume and aligns each receptacle with the cheese outlet to enable blocks of cheese to enter the outlet flume.

3. The apparatus as recited in claim 1 wherein the drive mechanism of the carousel comprises a sprocket, a motor connected to drive the sprocket, and chain engaging the sprocket, wherein the plurality of receptacles are attached to the chain.

4. The apparatus as recited in claim 1 wherein the fluid circulation system produces a flow of liquid in the inlet flume which flow carries the blocks of cheese to the cheese inlet.

5. The apparatus as recited in claim 4 further comprising a reservoir into which the liquid flows from the outlet flume, and the fluid circulation system draws the liquid from the reservoir.

6. The apparatus as recited in claim 4 wherein the fluid circulation system further comprises a cooling circuit having a fluid inlet which receives liquid and a fluid outlet connected to the tank, the cooling circuit including a pump and a heat exchanger connected in series between the fluid inlet and the fluid outlet, wherein the heat exchanger cools liquid flowing there through.

7. The apparatus as recited in claim 1 wherein the fluid circulation system comprises a heat exchanger which cools the liquid flowing there through.

8. The apparatus as recited in claim 1 wherein the fluid circulation system produces a flow of the liquid through the inlet flume, the tank and the outlet flume whereby blocks of cheese are carried by that flow of liquid.

9. A cheese cooling apparatus comprising:

a tank for containing a liquid and having a cheese inlet and a cheese outlet;

an inlet flume coupled to the cheese inlet of the tank;

an outlet flume coupled to the cheese outlet of the tank;

a fluid circulation system for producing a flow of the liquid through the inlet flume, the tank and the outlet flume whereby blocks of cheese are carried by that flow of the liquid; and

a carousel having a plurality of receptacles to hold the blocks of cheese and a drive mechanism attached to the plurality of receptacles, wherein the carousel sequentially moves each receptacle into alignment with the cheese inlet to receive blocks of cheese carried by the flow of the liquid and into alignment with the cheese outlet to enable blocks of cheese to be carried by the flow of the liquid into the outlet flume.

10. The apparatus as recited in claim 9 wherein the carousel further moves each receptacle in a closed path within the tank and submerge the blocks of cheese in the liquid.

11. The apparatus as recited in claim 9 wherein the fluid circulation system comprises a cooling circuit which produces a flow of the liquid through the tank, and a heat exchanger that cools liquid flowing in the cooling circuit.

12. An apparatus for cooling cheese blocks, said apparatus comprising:

a tank for containing liquid and being divided into a plurality of cooling cells with each cooling cell having a cheese inlet and a cheese outlet;

a plurality of carousels with each one located in a different cooling cell and having a plurality of tubes for holding the cheese blocks, the plurality of carousels further having a drive mechanism for submerging the plurality of tubes in liquid contained in the tank;

an inlet flume system connected to the cheese inlet of each of the plurality of cooling cells and having a control gate mechanism for selectively directing cheese blocks moving along inlet flume system into each of the plurality of cooling cells; and

an outlet flume system connected to the cheese outlet of each of the plurality of cooling cells for receiving cheese blocks from the tank.

13. The apparatus as recited in claim 12 wherein the drive mechanism moves the plurality of tubes in a closed path through a respective cooling cell.

13. The apparatus as recited in claim 12 wherein the inlet flume system comprises an inlet flume, and a plurality of side channels extending from inlet flume to each cheese inlet of the plurality of cooling cells.

14. The apparatus as recited in claim 13 wherein the inlet flume system further comprises a movable gate at each junction of one of the plurality of side channels with the inlet flume, the movable gate for directing the cheese block from the inlet flume into the respective side channel.

15. The apparatus as recited in claim 12 wherein the outlet flume system comprises an outlet flume and a plurality of outlet channels each extending from one of the plurality of cooling cells to the outlet flume.

16. The apparatus as recited in claim 15 wherein the outlet flume system further comprises a movable gate at each junction of one of the plurality of outlet channels with the outlet flume, the movable gate for directing cheese blocks along the outlet flume.

17. The apparatus as recited in claim 12 further comprising fluid circulation system connected to the tank and producing a flow of liquid in the tank.

18. The apparatus as recited in claim 17 wherein the fluid circulation system further comprises a reservoir into which liquid flows from the outlet flume system.

19. The apparatus as recited in claim 17 wherein the fluid circulation system produces a flow of liquid into the cheese inlet of each of the plurality of cooling cells and a flow of the liquid from the cheese outlet of each of the plurality of cooling cells.

20. The apparatus as recited in claim 17 wherein the fluid circulation system further comprises a cooling circuit having an inlet which receives the liquid and an outlet connected to the tank, the cooling circuit including a pump and a heat exchanger connected in series between the inlet and the outlet, wherein the heat exchanger cools the liquid flowing there through.

21. The apparatus as recited in claim 20 wherein the cooling circuit comprises a distribution conduit which receives liquid that has been cooled by the heat exchanger; and a plurality of valves connecting the distribution conduit to the plurality of cooling cells.

22. The apparatus as recited in claim 21 further comprising a controller which selectively opens the plurality of valves.

23. The apparatus as recited in claim 20 wherein the cooling circuit further comprising a plurality of inter-cell pumps each connected to the cooling tank to transfer the liquid between selected ones of the plurality of cooling cells.

24. The apparatus as recited in claim 12 wherein the drive mechanism of the carousel comprises a chain which rides on a plurality of sprockets, wherein the plurality of tubes are attached to the chain; and a motor connected to drive one of the plurality of sprockets.

25. The apparatus as recited in claim 12 further comprising a sensor located in one of the inlet flume system and the outlet flume system for detecting presence of a cheese block.

26. The apparatus as recited in claim 12 further comprising a retractable stop located in the inlet flume system for controlling movement of cheese blocks along the inlet flume system.

27. The apparatus as recited in claim 12 further comprising a plurality of retractable stops each located in the cheese outlet of one of the plurality of cooling cells for controlling movement of cheese blocks through the cheese outlet.

28. A method for cooling cheese blocks comprising:

utilizing a flow of liquid to carry the cheese blocks along an inlet flume;

sequentially diverting the flow of liquid from the inlet flume into each one of a plurality of cooling cells, thereby directing the cheese blocks into the plurality of cooling cells;

storing the cheese blocks in a carousel within each one of the of plurality of cooling cells;

operating each carousel to submerge the cheese blocks in liquid within the plurality of cooling cells; and

after the cheese blocks in a given cooling cell have cooled a predefined amount, producing a flow of liquid which carries the cheese blocks out of the given cooling cell.

29. The method recited in claim 28 further comprising generating a flow of chilled liquid through the plurality of cooling cells.

30. The method recited in claim 28 further comprising introducing chilled liquid into a selected cooling cell; and directing the liquid to flow from the selected cooling cell through the remaining ones of the plurality of cooling cells.

31. The method recited in claim 30 wherein each time the liquid is directed from one cooling cell to another cooling cell, the liquid leaves a cooling cell containing cheese that is colder than the cheese in a cooling cell that the liquid is entering.

32. An apparatus for cooling cheese blocks, said apparatus comprising:

a tank for containing liquid and being divided into a plurality of cooling cells with each cooling cell having a cheese inlet and a cheese outlet;

a plurality of carousels with each one located in a different cooling cell and having a plurality of tubes for holding the cheese blocks, the carousel further having a drive mechanism for moving the plurality of tubes within the cooling cell to submerge the cheese blocks in the liquid;

an inlet flume system connected to the cheese inlet of each of the plurality of cooling cells and having a control gate mechanism for directing cheese blocks moving along inlet flume system into a selected one of the plurality of cooling cells;

a plurality of retractable stops each associated with a different cheese outlet to detain cheese blocks in an associated one of the plurality of cooling cells;

an outlet flume system connected to the cheese outlet of each of the plurality of cooling cells for receiving cheese blocks from the tank; and

a controller which operates the plurality of retractable stops, drive mechanisms of the plurality of carousels, and the gate mechanism.

33. The apparatus as recited in claim 32 further comprising a system for circulating a liquid through the plurality of cooling cells.

34. The apparatus as recited in claim 33 wherein the system for circulating a liquid comprises a cooling circuit having a fluid inlet which receives liquid from the tank, a distribution conduit, a pump and a heat exchanger connected in series between the fluid inlet and the distribution conduit, and a plurality of valves operated by the controller to selectively enable flow of the liquid from distribution conduit to each of the plurality of cooling cells.

35. The apparatus as recited in claim 34 wherein the cooling circuit further comprises a plurality of inter-cell pumps each connected to the cooling tank to transfer the liquid among the plurality of cooling cells.

36. The apparatus as recited in claim 33 wherein the system for circulating a liquid comprises a flume circuit having a fluid inlet to receive liquid, a fluid outlet connected to direct the liquid into the inlet flume, and a pump connected between the fluid inlet and the fluid outlet.

37. The apparatus as recited in claim 32 further comprising another retractable stop in the inlet flume to detain cheese blocks therein.

38. A method for cooling cheese blocks comprising:

placing a plurality of cheese blocks sequentially into different sections of a tank, wherein the sections contain cheese blocks that have been in the tank for different amounts of time; and

flowing liquid through the tank from a section that contains cheese blocks that have been in the tank substantially the greatest amount of time toward a section that contains cheese blocks that have been in the tank substantially the least amount of time.

39. The method as recited in claim 38 wherein placing a plurality of cheese blocks sequentially into different sections of a tank comprises sequentially directing cheese blocks from an inlet flume into each one of a plurality cooling cells, wherein the cheese blocks in each cooling cell at a given point in time have been in the tank different amounts of time than the cheese blocks in other cooling cells.

40. The method as recited in claim 38 wherein flowing liquid through the tank comprises:

introducing chilled liquid into a given cooling cell that contains cheese blocks which have been in the tank for substantially the greatest amount of time;

transferring liquid from the given cooling cell into the cooling cell contains cheese blocks which have been in the tank for the next greatest amount of time; and

continuing to transfer liquid successively between a pair of cooling cells, wherein the liquid is transferred into one cell of the pair that contains cheese blocks which have been in the tank for a lesser amount of time than the other cell of the pair.

41. The method as recited in claim 38 further comprising removing liquid from the cooling cell containing cheese blocks that have been in the tank substantially the least amount of time.